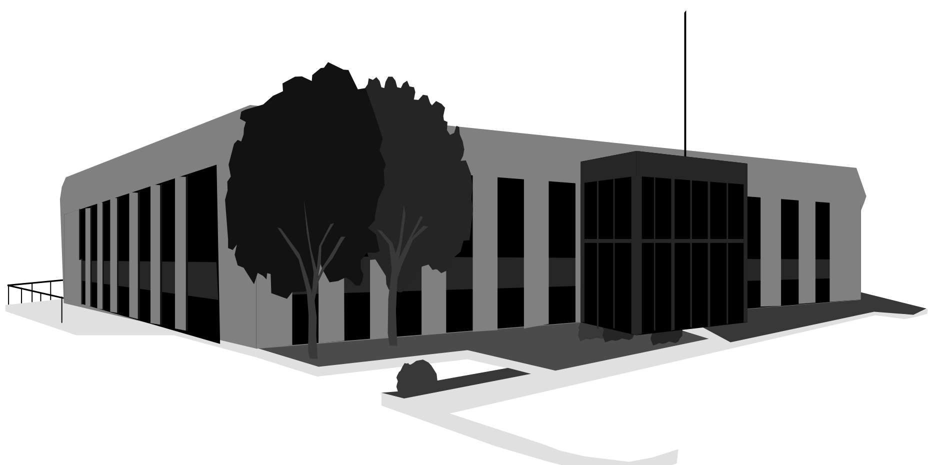
INDOOR AIR QUALITY ASSESSMENT

Amesbury Town Hall
86 Friend Street
Amesbury, Massachusetts



Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health Assessment

July, 2001

Background/Introduction

At the request of the Amesbury Board of Health, the Massachusetts Department of Public Health (MDPH), Bureau of Environmental Health Assessment (BEHA) provided assistance and consultation regarding indoor air quality concerns at the Amesbury Town Hall, 86 Friend Street, Amesbury, Massachusetts. On May 23, 2001, a visit was made to this office by Michael Feeney, Chief of Emergency Response/Indoor Air Quality (ER/IAQ), BEHA to conduct an indoor air quality assessment. During the visit, BEHA staff received complaints from building occupants of increased rashes, allergies, tiredness and flu-like symptoms.

The town hall is a two-story building constructed as an armory in the late 1800's. Windows are openable and consist of single paned glass in metal window frames. The building consists of two sections: front and rear. The front of the building contains two floors that house town offices. The basement contains a finished area that was formerly used as an office. Currently located in the basement are rest rooms, the vault, boiler room and storage areas. The rear of the building is a large auditorium that originally had an open balcony. The balcony was enclosed and converted into offices. The area beneath the balcony was also enclosed and converted into office space. Windows are openable in a number of offices in the building.

Due to indoor air quality concerns, a consultant evaluated the building a month prior to the BEHA assessment (ATC, 2001). The ATC report recommended that 1) carpet be replaced in the CFO and Assessor's Office and cleaned in other offices, 2) water damaged ceiling tiles be replaced, and 3) that windowsills be sealed and disinfected. Offices proposed for carpet removal were to be sealed with plastic and tape.

At the time of the BEHA assessment, employees in second floor offices on the east side front of the town hall were in the process of packing in order to move to alternative office space until remedial efforts were complete.

Methods

Air tests for carbon dioxide, temperature and relative humidity were taken with the TSI, Q-Trak, IAQ Monitor, Model 8551.

Results

Amesbury Town Hall has an employee population of approximately 23. Tests were taken under normal operating conditions. Test results appear in Tables 1-2.

Discussion

Ventilation

It can be seen from the tables that carbon dioxide levels were above 800 parts per million of air (ppm) in three out of eighteen areas sampled, indicating adequate air exchange in most areas. Please note that open windows can reduce carbon dioxide levels, many of which were found open in a number of areas. Office space does not have mechanical ventilation. Each room has a radiator beneath the window which provides heat. The sole source of fresh air is the openable windows.

Of note is the configuration of the engineer’s offices that were converted from auditorium balcony space. The balcony was enclosed by the installation of gypsum wallboard and sliding windows (see Figure 1, Picture 1). The engineer's office window cannot be opened due to the installation of a window-mounted air conditioner. The sealing of the window creates a cul-de-sac where air movement into these offices from the hallway would be limited if the sliding windows are closed.

Some rest rooms have mechanical exhaust ventilation. The mechanical exhaust ventilation system in the second floor restroom is controlled by activating the light switch. Without active exhaust ventilation, rest room odors and moisture can penetrate into adjacent hallways and offices. With the lack of exhaust ventilation, pollutants that exist in the interior space can build up and remain inside the building, which can subsequently lead to indoor air complaints. Of note is the terminus of the handicap restroom vent, which ends in a cardboard box in the crawl space beneath the workroom (see Picture 2). This configuration can result in restroom odors penetrating into occupied space. With the restroom exhaust vent deactivated, cold crawlspace air can travel backwards up the flexible duct and into the restroom.

An exhaust vent exists in the ceiling of the kitchen area located outside the engineer's offices. The kitchen ceiling was installed with a similar type of flexible hose to that of the duct in the crawlspace. This flexible duct was in three pieces, originally joined with tape (see Pictures 3 through 5). If the vent is operated, air is injected into the ceiling plenum.

The Massachusetts Building Code requires a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or have openable windows in each room (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The Department of Public Health uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches.

Temperature readings were measured in a range of 66^{o} F to 71^{o} F in occupied areas, which were close to the lower end of the BEHA recommended comfort range. The BEHA recommends that indoor air temperatures be maintained in a range of 70^{o} F to 78^{o} F in order to provide for the comfort of building occupants. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply. Concerns about lack of control over heat in office spaces during winter months and complaints of excessive heat during summer months were expressed to BEHA staff. The window system is single-paned, which is prone to heating complaints, particularly on the south side of the building. Adding to the heat load within the building is the introduction of computers, LaserJet® printers, photocopiers, refrigerators and facsimile machines. Each piece of equipment produces waste heat. Since the building was built prior to 1900, it was not designed to handle modern office equipment; the combination of a lack of exhaust ventilation with waste heat producing equipment and single-paned window systems can make temperature control difficult. While temperature readings outside the recommended comfort range are generally not a health concern, increased temperature can affect the relative humidity in a building.

The relative humidity in the building was within the BEHA recommended comfort range of 40 to 60 percent in all areas sampled the day of the assessment. Relative humidity measurements ranged from 40 to 46 percent. During the heating season, relative humidity levels would be expected to drop below the recommended comfort range. The sensation of dryness and irritation is common in a low relative humidity environment. For buildings in New England, periods of low relative humidity during the winter are often unavoidable.

Of note is the level of relative humidity in the basement. Relative humidity levels in the basement were 59 percent, which is 5 percent greater than the outdoor relative humidity measured during the assessment (54 percent) without occupancy in the basement. The interior door and outer entrance doors were both sealed with duct tape and plastic, thereby minimizing air movement. The relative humidity measurement indicates that a moisture source exists in the basement that is independent of occupancy.

Mold/Microbial Growth

The increased relative humidity in the basement can be attributed to several sources on the exterior of the building (see Figure 2). The one major source of water penetrating into the basement appears to be water runoff from a peaked roof on a house immediately adjacent to the town hall (see Picture 6). The alleyway between the town hall and house is covered by cement (see Picture 7). The roof does not have a gutter/downspout system, which results in rainwater collecting on the ground between buildings. No drain appears to exist in the alleyway. Collected water in the alleyway may then penetrate into the basement. Confirming this moisture pathway is the presence of efflorescence along exterior walls in the restroom (see Picture 8). Efflorescence is a characteristic sign of water damage to brick and mortar, but it is not mold growth. As moisture penetrates and works its way through mortar around brick, water-soluble compounds in bricks and mortar dissolve, creating a solution. As the solution moves to the surface of the brick or mortar, the water evaporates, leaving behind white, powdery mineral deposits.

Another major source of collecting water in the alley is the configuration of the town hall roof. As reported by town hall employees, the roof over the front section of the building is flat and sloped towards the alleyway side of the building. This configuration allows for water to run down the east wall of the building. Water exposure to the east wall is confirmed by several conditions.

First, masonry near the roof is damaged (see Picture 9) reportedly from roof-water run off. Brick is damaged to the point where a plant was seen growing from the brickwork (see Picture 10). Damaged exterior brick can lead to increased water penetration that can damage window frames and interior plaster.

Secondly, masonry around windows appeared to be eroded from significant water damage. This erosion may account for possible water penetration into the wall cavities on the town hall's east wall. Confirming this assumption is water damage to wall plaster in and around windows in the east wall stairwell (see Picture 11). If water has penetrated into the wall cavity, interior wall materials may have become repeatedly moistened by rain. Wall materials, such as paneling, can serve as a mold growth medium. Wall plaster is not a good mold growth media, however water trapped behind wallpaper or paint coats can become mold growth media. Thirdly, the seam between the alley cement and east exterior wall is open, making this area prone to water penetration from rainwater runoff.

Lastly cracked block windows in the ladies restroom are filled with water and have algae growth (see Picture 12). Since this window is on the first floor in a sheltered area, the most likely source of rainwater that could fill these glass blocks would be rainwater running down the side of the east wall. All of these conditions indicate that significant water exposure and penetration exists along the east side of this building. Once moisture enters a wall cavity, microbial growth may occur in building materials and/or water may penetrate into occupied areas.

Other sources of relative humidity in the basement are exterior holes in the foundation, sills, steps and exterior wall (see Picture 13 through 15). Uncontrolled air penetration can result in moisture penetrating into the building; particularly through holes in the floor were utilities enter the building. With increased water penetration and no mechanical ventilation system, water vapor and accumulation in the basement appears to have resulted in the moistening of materials that can serve as mold growth media. Cardboard, paper, gypsum wallboard, ceiling tiles and carpeting can all serve as mold growth media. If porous materials are allowed to remain moistened for an extended period of time, mold growth may occur. The American Conference of Governmental Industrial Hygienists (ACGIH) recommends that porous materials be dried with fans and heating within 24 hours of becoming wet (ACGIH, 1989). If porous materials are not dried within this time frame, mold growth may occur. Water-damaged porous materials cannot be adequately cleaned to remove mold growth. The application of a mildewcide to moldy materials is not recommended.

Means for moisture to penetrate into the auditorium crawl space also exists. Opportunities for water penetration through the building envelope are created along the exterior wall/tarmac junction. Several downspouts exist which empty above the wall/tarmac junction, resulting in splashing rainwater in this area (see Picture 16). Plants were noted growing in the junction between the exterior wall and the tarmac (see Picture 17), which can collect water that accumulates in this area. Freezing and thawing of gathered water can result in damage to the exterior wall, which can result in water penetration into the building.

Water damaged ceiling tiles exist in a number of areas on the second floor, which confirms the known problems associated with rainwater leaks through the roof. Water-damaged ceiling tiles can provide a source of microbial growth and should be repaired/replaced after a water leak is discovered.

Several areas contained plants (see Picture 18). Moistened plant soil, drip pans and standing water can serve as a source of mold growth. Plants should be equipped with drip pans and over watering should be avoided.

Other Concerns

The building has undergone periodic renovations over the past several years. The building was retrofitted with a computer network. Holes were noted around pipes connected to the heating system (see Picture 19) and plumbing (see Picture 20). In the town clerk's storage room, a sink system was removed and the holes remaining in the floor were covered with cardboard (see Picture 21). In addition, the installation of computer network cables necessitated the drilling of numerous holes in interior walls and floors (see Picture 22). The drilling of these holes has created plaster dust as well as a means for pollutants from one room to penetrate into an adjacent room. In addition, materials within the wall cavities now have a pathway into occupied space. As noted in the ATC report, any hole or space in the interior of offices along the exterior wall could serve as a pathway for wall cavity air and pollutants to penetrate into the occupied space. As an example, the engineer's office has an exterior wall penetration that formerly served as an exhaust vent for a blueprint machine (see Picture 23). This wall penetration can allow for wall cavity air to migrate into the engineer's office. Seams in walls/floors and ceiling, light switches, electrical outlets and seams in or around window frames in the internal east wall offices can all serve as pathways for pollutant migration as well. Since no mechanical exhaust system exists in the building, pollutants that penetrate into the office space can tend to accumulate. Elimination of pathways of potential wall cavity pollutants need to be identified and sealed.

Other areas of the building have entrances into storage areas of the building. The engineer's outer office has a large door leading to an attic space above the auditorium. Accumulated dust, dirt and other pollutants can move from the attic space into the outer engineer's office. Sealing the door can prevent pollutant migration.

Also of note was the amount of materials stored inside offices. Items were seen piled on windowsills, tabletops, counters, bookcases and desks throughout the building. In addition some offices are configured in a manner that makes regular cleaning/vacuuming difficult. The large amount of items stored provides a means for dusts, dirt and other potential respiratory irritants to accumulate. Many of the items, (e.g., papers, folders, boxes, etc.) are tough to clean and make it difficult for custodial staff to clean around these areas. Dust can be irritating to the eyes, nose and respiratory tract. These items should be relocated and/or cleaned periodically to avoid excessive dust build up.

Conclusions/Recommendations

The actions taken by Amesbury city officials to seal off office areas, removal of mold contaminated carpeting, relocation of employees and further examination of the materials and cavity of the east wall are both reasonable and prudent. In addition to these actions that are already underway, the following recommendations are made to improve indoor air quality:

1. Continue with plans to investigate and remediate water penetration through the east wall.
2. Continue to proceed with the recommendations made in the ATC report.
3. Continue with plans to examine the feasibility of repairing the roof and improving drainage to prevent east wall water damage.
4. Seal the alleyway cement/exterior wall junction with an appropriate sealing compound.
5. Examine the feasibility of having a downspout/gutter system installed on the peaked roof building to direct water away from the alleyway.
6. To improve air movement in the converted balcony office space, consider opening the sliding glass windows and place a floor fan in the opening to eject air from these offices into the auditorium.
7. Remove plants from the wall/tarmac junction around the perimeter of the building. Reconfigure downspouts to direct rainwater from the base of the building. Seal the wall/tarmac junction with an appropriate sealer.
8. Once the roof is repaired, repair water damaged plaster and examine the feasibility of repointing brickwork and repairing window frames along the east wall.
9. Seal the hole around former blueprint machine exhaust vent in the inner engineer's office.
10. Seal the holes in the foundation floor, walls, sills, stairs and exterior wall to reduce moisture penetration.
11. Install ductwork for the first floor restroom to expel exhaust air outdoors.

12. Remove disconnected ductwork above the second floor kitchen and outer engineer's office. Either replace the flexible duct with a single continuous piece or consider sealing this system to prevent air backflow from the roof.

13. Examine all restroom exhaust vents to ensure that ductwork exits the building. Once ductwork is directing exhaust air outdoors, operate exhaust vents during business hours. Consider installing restroom exhaust vent fan controls that are independent of light switches.

14. This building was designed to use windows to provide fresh air. In order to temper room temperature and provide fresh air, the opening of windows is recommended.

15. Render the access door to the auditorium attic crawl space airtight with weather-stripping.

16. Seal holes in the floors, walls and ceilings for pipes and cables to prevent infiltration of pollutants from wall cavities.

17. Relocate or consider reducing the amount of materials stored to allow for more thorough cleaning. Clean items regularly with a wet cloth or sponge to prevent excessive dust build-up.

18. Consider removing below grade carpeting and replacing it with a non-porous surface.

19. Consider removing paint from the basement restroom wall to prevent brick damage and possible mold growth in paint.

20. Consider reconfiguring offices to improve the ability of cleaners to remove accumulated dust, dirt and other pollutants.

21. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, continue to use the HEPA filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

Materials Located within the Basement/Renovations

Stored materials and building materials in the basement may have mold contamination. In order to avoid potential mold and related spore movement during remediation of the basement area, the following recommendations should be implemented in order to reduce contaminant migration into occupied areas and to better understand the potential for mold to impact indoor air quality. We suggest that these steps be taken on any renovation project within a public building:

1. Establish communications between all parties involved with remediation efforts (including building occupants) to prevent potential IAQ problems. Develop a forum for occupants to express concerns about remediation efforts as well as a program to resolve IAQ issues.

2. Develop a notification system for building occupants immediately adjacent to (and above) the basement record storage area to report remediation/construction/

renovation related odors and/or dusts problems to the building administrator. Have these concerns relayed to the contractor in a manner that allows for a timely remediation of the problem.

3. When possible, schedule projects which produce large amounts of dusts, odors and emissions during unoccupied periods or periods of low occupancy.
4. Disseminate scheduling itinerary to all affected parties. This can be done in the form of meetings, newsletters or weekly bulletins.
5. Obtain Material Safety Data Sheets (MSDS) for all remediation/ decontamination materials used during renovations and keep them in an area that is accessible to all individuals during periods of building operations as required by the Massachusetts Right-To-Know Act (MGL, 1983).
6. Consult MSDS' for any material applied to the effected area during renovation(s) including any sealant, carpet adhesive, tile mastic, flooring and/or roofing materials. Provide proper ventilation and allow sufficient curing time as per the manufacturer's instructions concerning these materials.
7. Use local exhaust ventilation and isolation techniques to control remediation pollutants. Precautions should be taken to avoid the re-entrainment of these materials into the building's HVAC system. The design of each system must be assessed to determine how it may be impacted by renovation activities. Specific HVAC protection requirements pertain to the return, central filtration and supply components of the ventilation system. This may entail shutting down systems (when possible) during periods of heavy construction and demolition, ensuring systems are isolated from contaminated environments, sealing ventilation

openings with plastic and utilizing filters with a higher dust spot efficiency where needed (SMACNA, 1995).

8. Seal utility holes, spaces in roof decking and temporary walls to eliminate pollutant paths of migration. Seal holes created by missing tiles in the ceiling temporarily to prevent renovation pollutant migration.

9. Seal hallway doors with polyethylene plastic and duct tape. Consider creating an air lock of a second door inside the remediation spaces to reduce migration.

10. If possible, relocate susceptible persons and those with pre-existing medical conditions (e.g., hypersensitivity, asthma) away from the general areas of remediation until completion.

11. Implement prudent housekeeping and work site practices to minimize exposure to spores. This may include constructing barriers, sealing off areas, and temporarily relocating furniture and supplies. To control for dusts, a high efficiency particulate air filter (HEPA) equipped vacuum cleaner is recommended. Non porous materials (e.g., linoleum, cement, etc.) should be disinfected with an appropriate antimicrobial agent. Non-porous surfaces should also be cleaned with soap and water after disinfection.

References

ACGIH. 1998. American Conference of Governmental Industrial Hygienists. Industrial Ventilation A manual of Recommended Practice. 23rd Edition. 1998.

ATC. 2001. Amesbury Town Hall Indoor Air Quality Investigation ATC Project No: 6020979.002. Dated May 8, 2001. ATC Associates Inc. Woburn, MA.

BOCA. 1993. The BOCA National Mechanical Code-1993. 8th ed. Building Officials & Code Administrators International, Inc., Country Club Hills, IL. M-308.1

MGL. 1983. Hazardous Substances Disclosure by Employers. Massachusetts General Laws. M.G.L. c. 111F.

OSHA. 1997. Limits for Air Contaminants. Occupational Safety and Health Administration. Code of Federal Regulations. 29 C.F.R. 1910.1000 Table Z-1-A.

SBBRS. 1997. Mechanical Ventilation. State Board of Building Regulations and Standards. Code of Massachusetts Regulations. 780 CMR 1209.0

SMACNA. 1995. IAQ Guidelines for Occupied Buildings Under Construction. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

Figure 1

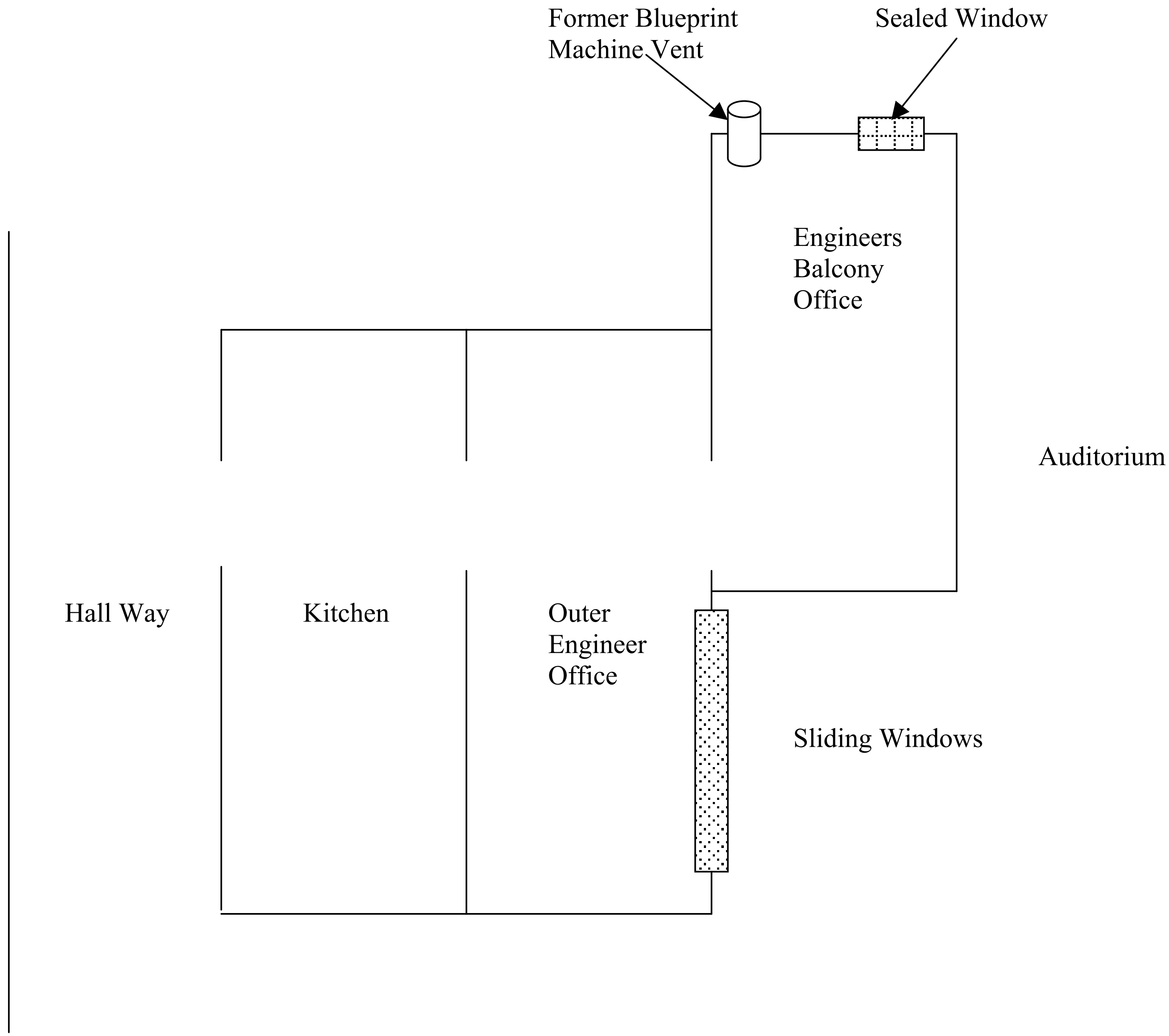
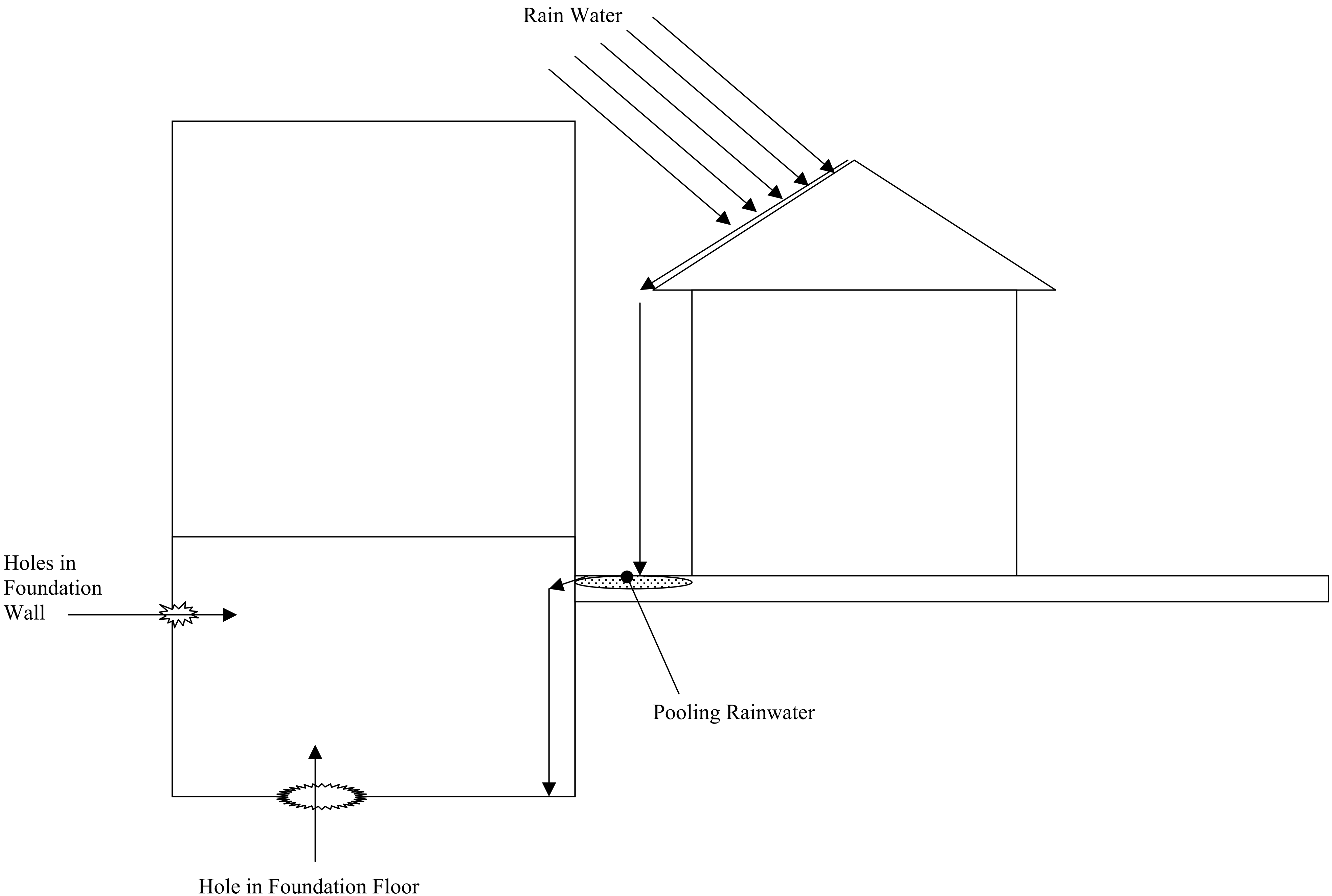

Former Blueprint
Machine Vent
Sealed Window
Engineers
Balcony
Office
Auditorium
Hall Way
Kitchen
Outer
Engineer
Office
Sliding Windows

Figure 2 Means of Water and Its Vapor to Penetrate into Amesbury Town Hall



Picture 1

Sliding Glass Windows in Engineer's Outer Office

Picture 2

Handicap Restroom Vent in Crawl Space

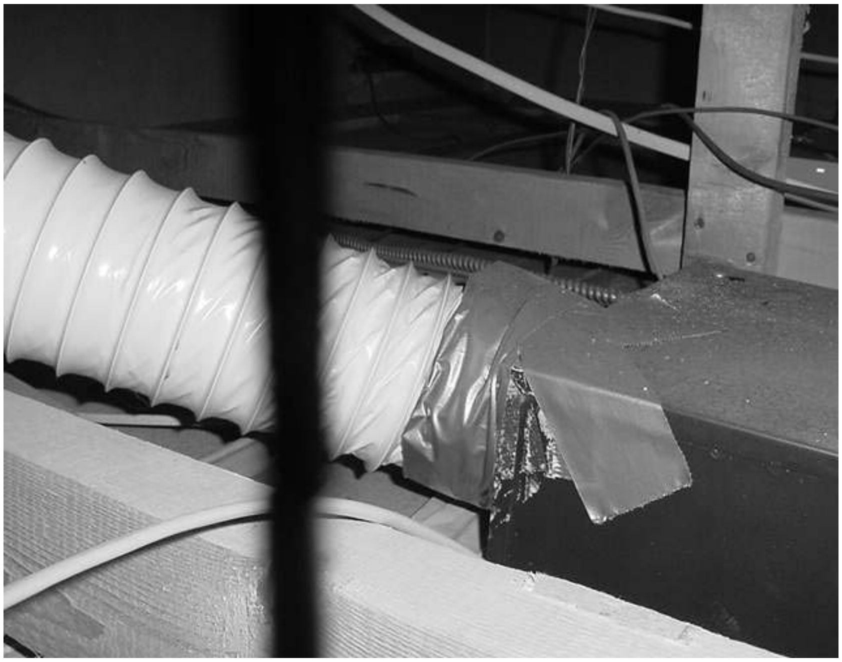
Picture 3

Flexible Duct Section above Engineer's Office

Picture 4

Flexible Duct Section in Wall Separating Engineer's Office from Kitchen. Note Duct Tape

Picture 5



Flexible Duct Section Above Kitchen Ceiling

Picture 6

A Peaked Roof On A House Immediately Adjacent To the Town Hall

Picture 7

Alleyway between the Town Hall and House

Picture 8

Efflorescence along Exterior Walls in the Restroom

Picture 9

Masonry near the Roof Is Damaged

Picture 10

Plant Was Seen Growing From the Brickwork

Picture 11

Water Damage to Wall Plaster in And Around Windows in the East Wall Stairwell

Picture 12

Cracked Block Windows In The Ladies Restroom Are Filled With Water And Have Alga Growth

Picture 13

Holes In Brickwork of Exterior Wall

Picture 14

Drainpipe Through Foundation Floor In Basement, Located Behind A Door

Picture 15

Holes In Front Stairwell to the Outdoors

Picture 16

Several Downspouts Exist And Empty Above The Wall/Tarmac Junction, Which Can Result Is Splashing Rainwater To Accumulate In This Junction

Picture 17

Plants Were Noted Growing In the Junction between The Exterior Wall And The Tarmac

Picture 18

Several Areas Contained Plants

Picture 19

Holes For Pipes Connected to the Heating System

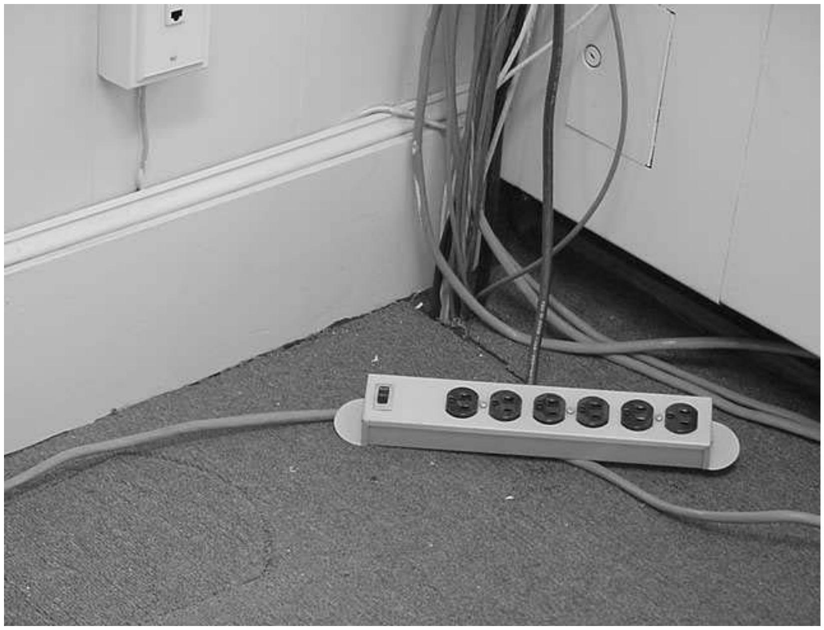
Picture 20

Holes For Pipes Connected to the Heating System

Picture 21

Holes Remaining in the Floor Were Covered With Cardboard

Picture 22



Computer Network Cables Necessitated the Drilling of Numerous Holes in Interior Walls and Floors

Picture 23

Exterior Wall Penetration That Formerly Served as an Exhaust Vent for a Blueprint Machine

TABLE 1

Indoor Air Test Results – Amesbury Town Hall, 86 Friend Street, Amesbury, MA – May 23, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Outside (Background)	423	59	54					
First Floor Photocopier Area	543	66	44	0	No	No	No	Photocopier
First Floor Hallway	580	66	44	0	No	No	No	Holes in tin ceiling
Town Clerk's Office	714	68	45	2	No	No	No	Window mounted A/C, door open
Town Clerk Storage	688	68	43	0	No	No	No	Holes in floor
First Floor Restroom-Women's						No	Yes	Exhaust off-broken, broken block-glass, water damage,
Auditorium	701	68	46	3	Yes	No	No	Ceiling fans, door open
Engineer's Office	657	68	45	2	No	No	No	2 water damaged CT-from exhaust vent
Engineer's Private Office	681	70	43	2	No	No	No	Abandoned exhaust vent – blueprint machine
Basement	485	63	59				Yes	Exhaust fan
Mayor's Outer Office	711	69	51					

*** ppm = parts per million parts of air**
CT = ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 2

Indoor Air Test Results – Amesbury Town Hall, 86 Friend Street, Amesbury, MA – May 23, 2001

Location	Carbon Dioxide *ppm	Temp. °F	Relative Humidity %	Occupants in Room	Windows Openable	Ventilation		Remarks
						Intake	Exhaust	
Community & Economic Development Planning - (CED)	672	70	40	0	No	No	No	Window mounted A/C-0n, plants, door open
CED – Direct	629	69	40	0	No	No	No	Window mounted A/C-on
Second Floor Hallway	698	70	42	0	Yes	No	No	Holes in ceiling, plants
Second Floor Photocopier Area	645	69	42	0	No	No	No	Photocopier, refrigerator, coke machine, 4 water damaged CT, door open
CFO	695	69	43	1	No	No	No	Carpet, window mounted A/C, door open, water damaged windowsills
Town Accountant	819	70	42	6	Yes	No	No	Window and door open, 5 water damaged CT, hole in CT
Treasurer – Main Office	830	70	45	1	Yes	No	No	Window mounted A/C
Treasurer's Office	814	71	45	1	Yes	No	No	
Assessor's Office	663	68	45	2	Yes	Yes	Yes	Ceiling mounted air diffuser, door open

*** ppm = parts per million parts of air**
CT = ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred 600 - 800 ppm = acceptable > 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%

TABLE 3

Indoor Air Test Results – Amesbury Town Hall, 86 Friend Street, Amesbury, MA – May 23, 2001

*** ppm = parts per million parts of air**
CT = ceiling tiles

Comfort Guidelines

Carbon Dioxide -	< 600 ppm = preferred
	600 - 800 ppm = acceptable
	> 800 ppm = indicative of ventilation problems
Temperature -	70 - 78 °F
Relative Humidity -	40 - 60%